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(54) Fast dynamic measurement of bandwidth in a TCP network environment

(57) The fast dynamic measurement of bandwidth in a TCP network environment utilizes a single pair of packets to calculate bandwidth between two entities on a network (such as the Internet). This calculation is based upon the packet-pair technique. This bandwidth measurement is extremely quick. On its journey across a network, communication devices may delay the packet pairs. In particular, TCP networks have two algorithms designed to delay some packets with the goal of increasing the overall throughput of the network. However,

these algorithms effectively delay a packet pair designed to measure bandwidth. Therefore, they distort the measurement. These algorithms are Nagle and Slow Start. The fast dynamic measurement of bandwidth implements countermeasures to overcome the delays imposed by these algorithms. Such countermeasures include disabling the application of the Nagle Algorithm; minimizing the buffering of packets by sending a "push" packet right after the packet pair; and avoiding the Slow Start Algorithm by priming it with a dummy packet.

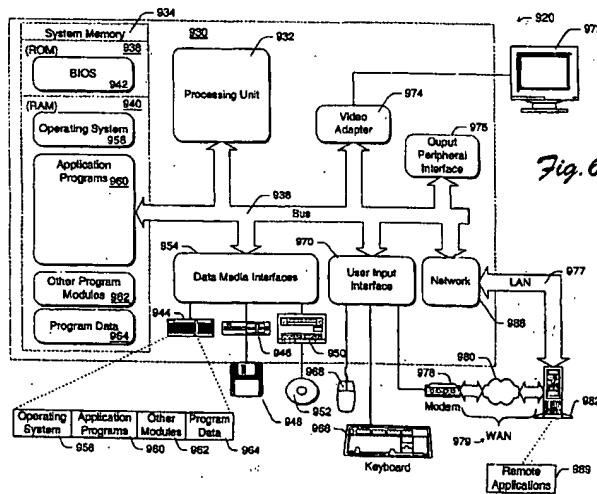


Fig. 6



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EUROPEAN SEARCH REPORT

Application Number

EP 01 11 8629

DOCUMENTS CONSIDERED TO BE RELEVANT		Relevant to claim	CLASSIFICATION OF THE APPLICATION (Int.Cl.)
Category	Citation of document with indication, where appropriate, of relevant passages		
Y	LAI K ET AL: "Measuring bandwidth" INFOCOM '99. EIGHTEENTH ANNUAL JOINT CONFERENCE OF THE IEEE COMPUTER AND COMMUNICATIONS SOCIETIES. PROCEEDINGS. IEEE NEW YORK, NY, USA 21-25 MARCH 1999, PISCATAWAY, NJ, USA, IEEE, US, 21 March 1999 (1999-03-21), pages 235-245, XP010323735 ISBN: 0-7803-5417-6 * abstract * paragraphs I, III, IV.B ---	1-38	H04L12/56
Y	MINSHALL G ET AL: "Application performance pitfalls and TCP's Nagle algorithm" 2ND WORKSHOP IN INTERNET SERVER PERFORMANCE (WISP 99). HELD IN CONJUNCTION WITH ACM SIGMETRICS 99 AND FCRC'99, ATLANTA, GA, USA, 1 MAY 1999, vol. 27, no. 4, pages 36-44, XP002233094 Performance Evaluation Review, March 2000, ACM, USA ISSN: 0163-5999 paragraphs 2 and 5 ---	1-8, 24, 25, 30, 33, 36	
Y	HAYES D A ET AL: "Impact of flow control on quality of service driven packet scheduling disciplines" CONTROL APPLICATIONS, 1999. PROCEEDINGS OF THE 1999 IEEE INTERNATIONAL CONFERENCE ON KOHALA COAST, HI, USA 22-27 AUG. 1999, PISCATAWAY, NJ, USA, IEEE, US, 22 August 1999 (1999-08-22), pages 1454-1459, XP010356221 ISBN: 0-7803-5446-X * page 1455, right-hand column, line 6 - line 12 * --- --- -/-	9-15, 26, 27, 31, 34, 37	H04L
The present search report has been drawn up for all claims			
Place of search	Date of completion of the search	Examiner	
MUNICH	16 June 2003	Ramenzoni, S	
CATEGORY OF CITED DOCUMENTS		T : theory or principle underlying the invention E : earlier patent document, but published on, or after the filing date D : document cited in the application L : document cited for other reasons & : member of the same patent family, corresponding document	
X : particularly relevant if taken alone Y : particularly relevant if combined with another document of the same category A : technological background O : non-written disclosure P : intermediate document			



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EUROPEAN SEARCH REPORT

Application Number

EP 01 11 8629

DOCUMENTS CONSIDERED TO BE RELEVANT		
Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim
Y	<p>NISHIDA Y ET AL: "CONGESTION CONTROL MECHANISM FOR TCP WITH PACKET PAIR SCHEME" IEICE TRANSACTIONS ON INFORMATION AND SYSTEMS, INSTITUTE OF ELECTRONICS INFORMATION AND COMM. ENG. TOKYO, JP, vol. E82-D, no. 4, April 1999 (1999-04), pages 854-862, XP000832568 ISSN: 0916-8532 paragraphs 4.3, 5.2.1 and 5.2.4</p> <p>-----</p>	16-23, 28,29, 32,35,38
TECHNICAL FIELDS SEARCHED (Int.Cl.7)		
The present search report has been drawn up for all claims		
Place of search	Date of completion of the search	Examiner
MUNICH	16 June 2003	Ramenzoni, S
CATEGORY OF CITED DOCUMENTS		
X : particularly relevant if taken alone	T : theory or principle underlying the invention	
Y : particularly relevant if combined with another document of the same category	E : earlier patent document, but published on, or after the filing date	
A : technological background	D : document cited in the application	
O : non-written disclosure	L : document cited for other reasons	
P : intermediate document	B : member of the same patent family, corresponding document	

**CLAIMS INCURRING FEES**

The present European patent application comprised at the time of filing more than ten claims.

Only part of the claims have been paid within the prescribed time limit. The present European search report has been drawn up for the first ten claims and for those claims for which claims fees have been paid, namely claim(s):

No claims fees have been paid within the prescribed time limit. The present European search report has been drawn up for the first ten claims.

LACK OF UNITY OF INVENTION

The Search Division considers that the present European patent application does not comply with the requirements of unity of invention and relates to several inventions or groups of inventions, namely:

see sheet B

All further search fees have been paid within the fixed time limit. The present European search report has been drawn up for all claims.

As all searchable claims could be searched without effort justifying an additional fee, the Search Division did not invite payment of any additional fee.

Only part of the further search fees have been paid within the fixed time limit. The present European search report has been drawn up for those parts of the European patent application which relate to the inventions in respect of which search fees have been paid, namely claims:

None of the further search fees have been paid within the fixed time limit. The present European search report has been drawn up for those parts of the European patent application which relate to the invention first mentioned in the claims, namely claims:



The Search Division considers that the present European patent application does not comply with the requirements of unity of invention and relates to several inventions or groups of inventions, namely:

1. Claims: 1 to 8, 24, 25, 30, 33, 36

Method (with correspondent programm module, computer-readable medium, apparatus and modulated data signal) for facilitating communication between two entities on a network, wherein a set of packets is sent from a sending entity to a receiving entity, comprising sending a delay-disable command.

2. Claims: 9 to 15, 26, 27, 31, 34, 37

Method (with correspondent programm module, computer-readable medium, apparatus and modulated data signal) for facilitating communication between two entities on a network, wherein a set of packets is sent from a sending entity to a receiving entity, comprising sending at least one "push" packet to avert a transmission delay between packets in the set, wherein the delay is caused by packet buffering of a communication device on the network.

3. Claims: 16 to 23, 28, 29, 32, 35, 38

Method (with correspondent programm module, computer-readable medium, apparatus and modulated data signal) for facilitating communication between two entities on a network, wherein a set of packets is sent from a sending entity to a receiving entity, comprising sending at least one "priming" packet to avoid a transmission delay between packets in the set, wherein the delay is caused by flow-control functions of a communication device on the network.